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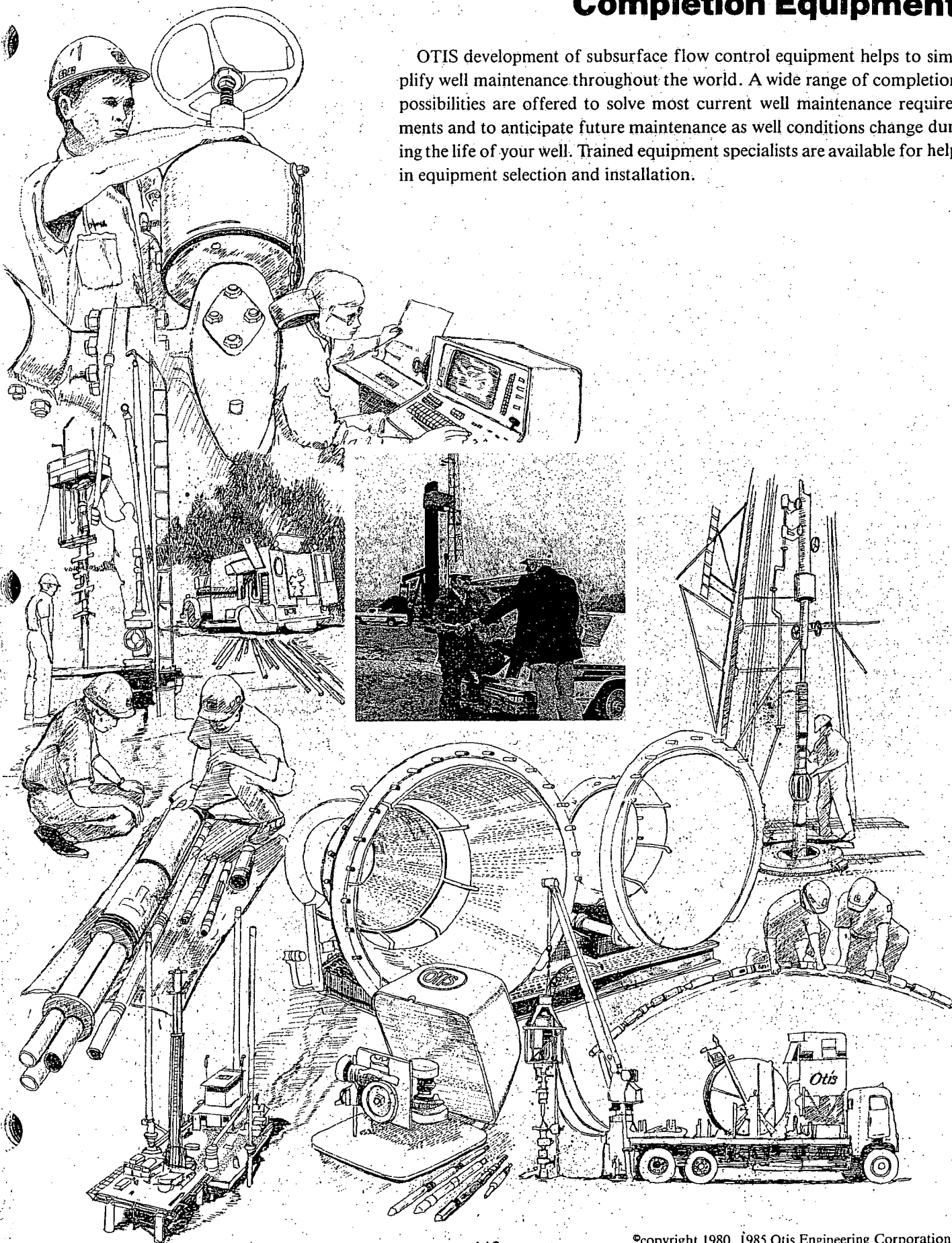
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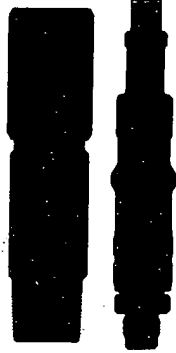
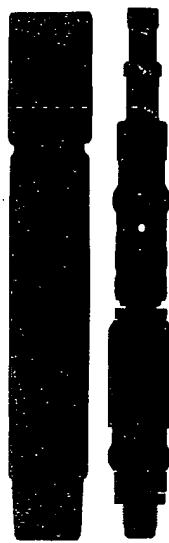






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# Otis® Subsurface Flow Control Completion Equipment

OTIS development of subsurface flow control equipment helps to simplify well maintenance throughout the world. A wide range of completion possibilities are offered to solve most current well maintenance requirements and to anticipate future maintenance as well conditions change during the life of your well. Trained equipment specialists are available for help in equipment selection and installation.



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## INTRODUCTION TO OTIS SUBSURFACE FLOW CONTROL COMPLETION EQUIPMENT

OTIS® flow control equipment is designed to simplify completion programs and help maintain production control for the life of the well. Flow control equipment has the versatility producers need in planning economical means of controlling flow downhole. For economy, future well maintenance requirements should be anticipated as accurately as possible during initial completions and well maintenance equipment installed to prevent excessive pulling jobs. Such equipment as OTIS Circulating Devices, Gas Lift Mandrels, Selective Landing Nipples and Safety Valve Nipples, can be installed initially and serviced by wireline methods in the future as required.

### OTIS WIRELINE PRODUCTION EQUIPMENT INSTALLATION GUIDE

**Flow Coupling/Selective Landing Nipple/Flow Coupling** made up in sequence, as shown, throughout the tubing string provide a choice of locations to install flow controls as well conditions change. Flow couplings are designed to protect the tubing from erosion caused by flow turbulence when flow controls are installed in the nipple.

**Flow Coupling/Selective Landing Nipple/Blast Joint/Polished Nipple** are made up in the tubing in the sequence as shown to span perforated areas. The blast joint protects the tubing against erosion from the formation perforations jetting action. Landing nipples and polished nipples provide locations for a packoff, if necessary, at a future date. Flow couplings are designed to protect tubing from erosion caused by flow turbulence.

**OTIS SLIDING SIDE DOOR® Circulation/Production Devices** are the most widely used selective circulation/production access tools in the oil and gas industry and are universally accepted with a design thoroughly proven through years of use. OTIS SLIDING SIDE DOOR Circulation/Production Devices are essentially full-opening devices with an inner sleeve that can be opened or closed using standard wireline methods to provide communication between the tubing and tubing/casing annulus. They feature a nipple profile (OTIS X® or R®) above the inner sliding sleeve and a polished pack-off area below as an integral part of the assembly. OTIS SLIDING SIDE DOOR Circulation/Production Devices are available in two versions, one shifts down to close and up to open; the other shifts up to close, down to open.

**OTIS No-Go Nipples** have a restricted I.D. to provide positive locating and to prevent flow controls from dropping out of the bottom of the tubing string during wireline operations. They are equipped with nipple profiles for locating chokes and other subsurface controls. Large bores permit

passage of properly sized through-tubing perforating guns, bottomhole pressure gauges, etc.

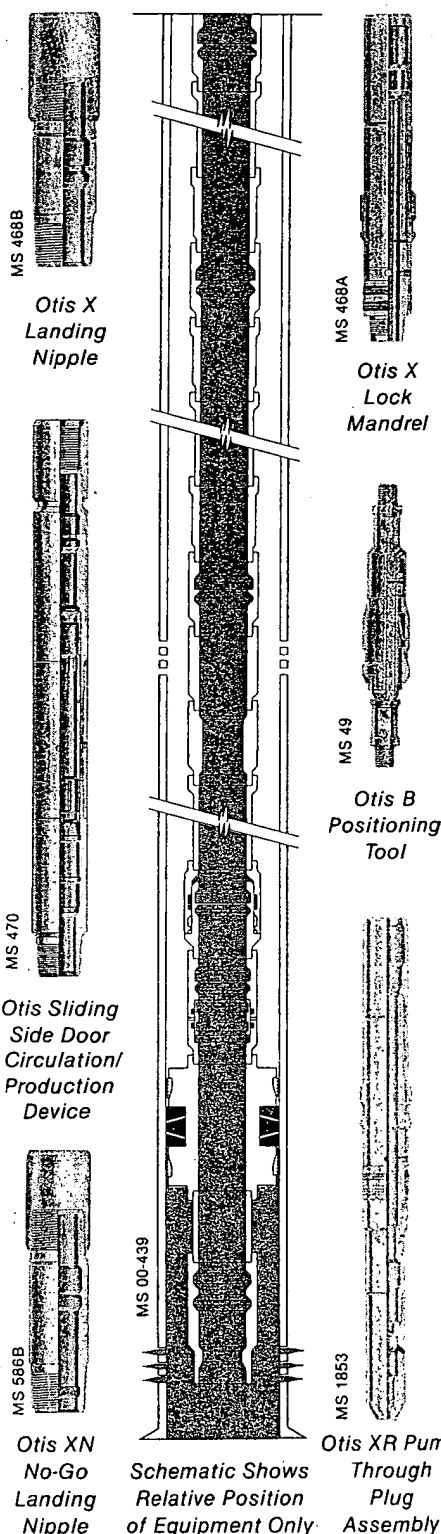
**NOTE:** OTIS Landing Nipples and related OTIS Flow Controls are available in sizes 1 inch thru 8 5/8 inch for standard or sour service. All subsurface flow controls can be specified for pumpdown application.

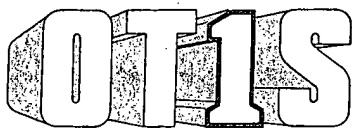
**OTIS Wellhead Landing Nipples** are designed to permit the well to be plugged temporarily while working on tree or moving rig.

**OTIS Lock Mandrels** are available in a variety of types to provide positive positioning of flow controls in a number of downhole situations. All OTIS Lock Mandrels are designed to be run by wireline under pressure without killing the well. OTIS X and R Selective Lock Mandrels permit the operator to control locating, locking and landing in any OTIS X or R Landing Nipple respectively, by means of the running tool. OTIS S Lock Mandrels are designed so they can be adjusted for locating into one of seven different OTIS S Landing Nipple profiles placed downhole in a progressive sequence. OTIS B, C and W Mandrels are slip-type mandrels designed to locate and lock without landing nipples. The D Mandrel is a collar lock mandrel that is designed to locate in API tubing collars. The RQ Lock Mandrels are designed to speed wireline work when running or pulling subsurface safety valves. Inside fish neck provides extra large I.D. for higher flow volumes.

**OTIS B Positioning Tool** is designed to open or close the inner sleeve in the OTIS SLIDING SIDE DOOR Circulation/Production Device. The positioning tool is run by wireline and shifts the inner sleeve into either an open or closed position. The OTIS XL Shifting Tool should only be used for shifting OTIS XXO or RRO Safety Valve Nipples.

**OTIS Plug Chokes**, set in no-go or selective nipples, are designed to be installed and retrieved by wireline. They are used for testing packers, plugging tubing prior to removing wellhead equipment, separating zones during production or stimulation procedures and whenever plugging the tubing is necessary.





## Subsurface Flow Control Completion Equipment

### OTIS LANDING NIPPLES AND LOCK MANDRELS SELECTIVE/NON-SELECTIVE BY RUNNING TOOL

Otis X® and R® Landing Nipples and Lock Mandrels (selective by running tool) and Otis XN™ and RN™ No-Go Landing Nipples and Lock Mandrels (non-selective) are designed to provide a degree of downhole selectivity. Now, an operator can place as many selective nipples with the same I.D. as desired in the production string (without regard to a specific sequence) to provide an unlimited number of positions for setting and locking subsurface flow controls. Then, one nipple can be selected that will be the best location for the flow control. If this location is unsatisfactory or well conditions change, the flow control may be moved up or down the wellbore wherever another nipple is located...all by wireline under pressure without killing the well.

Nipples have same I.D. for a particular tubing weight as indicated. Otis® X and XN Nipples are available for use with standard weight tubing; R and RN Nipples for heavy weight tubing. The "N" designation is for no-go nipples.

#### BENEFITS OF DESIGN PRINCIPLE

##### Otis X and R Landing Nipples

- Maximum versatility to reduce completion and production maintenance costs.
- A large bore to permit maximum flow capacity. A nipple bore compatible with tubing size and weight is available when using either X or R nipples.
- Unequalled in simplicity/selectivity when running, setting or retrieving subsurface flow controls.

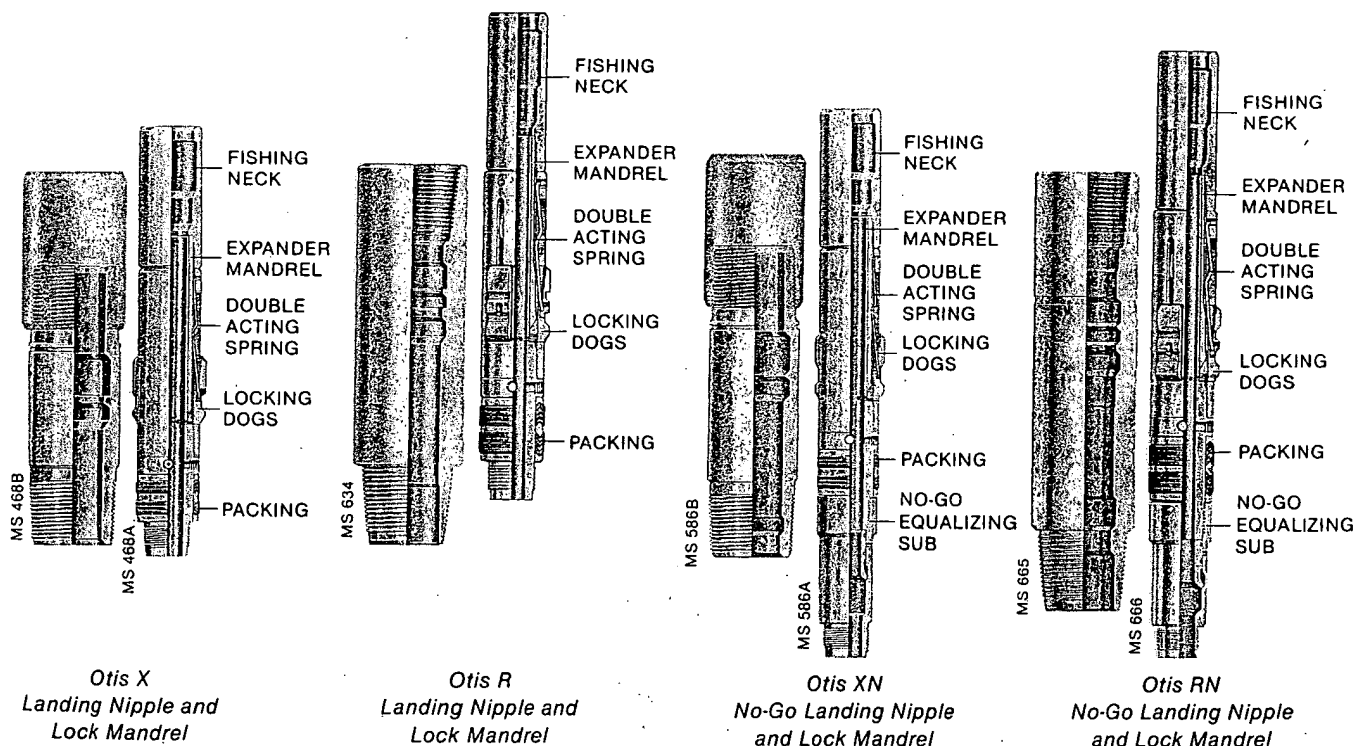
- Universal nipples with one internal profile (within each type: X-standard weight tubing; R-heavy weight tubing) to serve as a preselected landing location for subsurface flow control equipment.

##### Otis X and R Lock Mandrels

- Landing and locking keys are designed to be retracted to mandrel O.D. during running and pulling operations for faster wireline service.
- Wireline operator maintains control over locating, landing and locking in nipple of his choice. Nipple location may be selected before or after the mandrel and running tool are below the wellhead.
- Locking principle is designed to hold against pressure from either direction and sudden and/or repeated reversals of pressure.
- Inside fishing neck of both types of mandrels makes possible extra large I.D. for higher flow volumes.

##### Otis XN and RN No-Go Nipples and Mandrels (Non-Selective)

- Designed for use in single nipple installations or as the bottom nipple in conjunction with a series of X or R Landing Nipples.
- Full-opening packing bore, with locking recess at top of nipple with a slightly restricted no-go profile at the bottom, designed to keep subsurface flow controls from being run below the tubing intake.



## OTIS LANDING NIPPLES AND LOCK MANDRELS SELECTIVE/NON-SELECTIVE BY LOCATING MANDREL

The Otis® S Landing Nipple (selective by locating mandrel) and its related N No-Go Landing Nipple (non-selective) are designed to provide: (1) 7 predetermined selective landing locations in a single tubing string; (2) programmed locating through the use of selective locating keys; (3) simplicity in running and pulling to reduce production maintenance expense. Otis T Selective Nipples and Mandrels and related Q No-Go Nipples and Mandrels are available for heavy weight tubing.

Otis S or T Landing Nipples are available in a series of 7 different internal profiles. When all 7 profiles are used in a single tubing string, they are to be made up starting with the smallest number on the bottom and the largest number on the top, i.e. Position 1 on bottom, then coming up the string, Position 2 through 7.

Otis N or Q Landing Nipples are normally used in single nipple installations or as the bottom nipple when used in conjunction with a series of "selective" nipples.

### BENEFITS OF DESIGN PRINCIPLE

#### Otis S or T Landing Nipples

- Positive preselected selective landing location for Otis subsurface flow control equipment.
- Large I.D., a tubing bore of 1.875 inches in 2-inch tubing is available through the tubing string when you use S Nipples.

#### Otis S or T Locating and Lock Mandrels

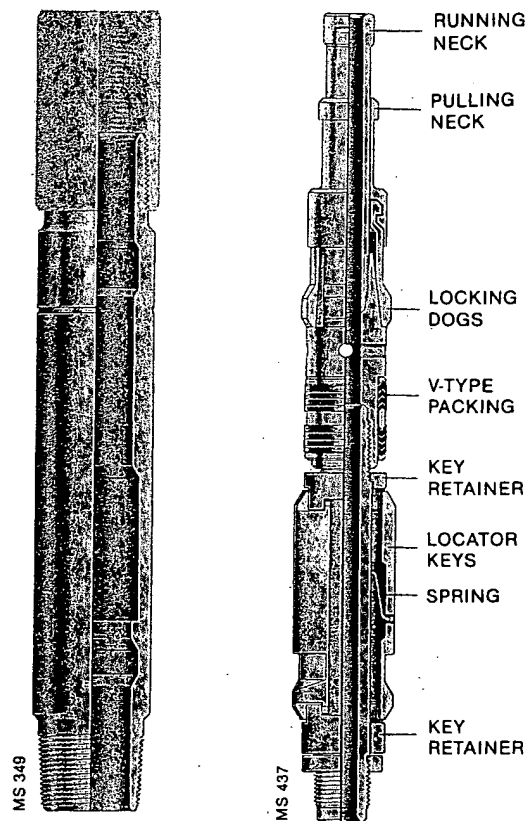
- Selective Locating Keys will only locate in nipple with matching position profile.
- Designed to withstand pressure from above or below.
- Sliding locator key mandrels are available for use with plugs to hold against sudden reversals of pressure differentials from above and below.

#### Otis N or Q No-Go Nipples

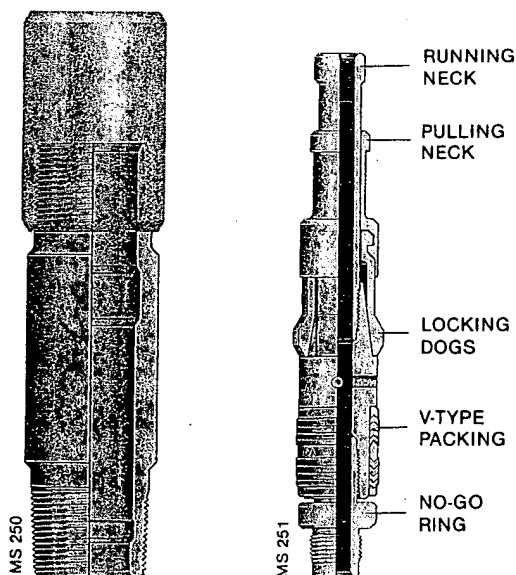
- Designed for single nipple installations or as bottom nipple when used with a series of "selective" nipples.
- Full-opening packing bore, with locking recess at top of nipple and a slightly restricted no-go at bottom designed to keep wireline tools from being run below tubing and lost.

#### Otis N or Q No-Go Mandrels

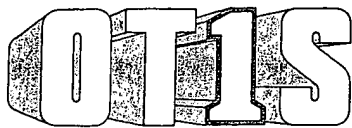
- Designed to land in Otis N or Q No-Go Nipples.
- No-go ring provided below packing.



*Otis S or T Landing Nipple and Lock Mandrel*



*Otis N or Q Landing Nipple and Lock Mandrel*



## Subsurface Flow Control Completion Equipment

### OTIS LANDING NIPPLES AND LOCK MANDRELS - Continued

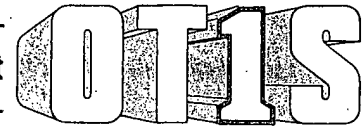
Guides are provided to help in the selection of Otis® Landing Nipples and Lock Mandrels for standard and heavy tubing weights. You have a choice of different bores under the headings X®, XN™, S and N (for standard tubing weights) and R®, RN™, T and Q (for heavy tubing weights). Standard bores are shown for nipple bore, packing bore and no-go (XN, RN, N and Q). Standard bores are normally recommended, as they are tubing drift or smaller. Optional bores are available on request. The respective I.D. and thread sizes for compatible lock mandrels are also shown.

**HOW TO ORDER:** Include: (1) Quantity of nipples and/or mandrels required; (2) Type of nipple and/or mandrels (X, XN, R, RN, RNT, S, T, N, Q, C, B, W or D); (3) nipple or packing bore; and (4) Tubing size, O.D., weight and thread. NOTE: If abnormal H<sub>2</sub>S or CO<sub>2</sub> conditions exist, indicate on your order. Lock mandrels are available in three standard materials: (1) 9 Chrome 1 Moly for sweet service, this material is suitable for use in applications where CO<sub>2</sub> and water are present without the presence of H<sub>2</sub>S; (2) 9 Chrome 1 Moly for sour service, this material is suitable for use where H<sub>2</sub>S, CO<sub>2</sub> and water are present in small to moderate concentrations; (3) Monel, this material is for use in high content CO<sub>2</sub>, water and/or H<sub>2</sub>S concentrations. 9 Chrome and Monel, when recommended for H<sub>2</sub>S service, are heat treated as per NACE MR-01-75 specifications. Your Otis Completion Specialist has additional ordering information. Call or write Otis, Dallas for the information you need.

GUIDE TO OTIS X AND XN LANDING NIPPLES AND LOCK MANDRELS  
Chart #0039z-c

TUBING				FOR STANDARD TUBING WEIGHTS			LOCK MANDREL	
				X	XN			
				SIZE (IN)	WT. LB/FT	I.D. (IN)	DRIFT (IN)	NIPPLE BORE (IN)
1.050	1.20	0.824	0.730	AVAILABLE ON REQUEST				
1.315	1.80	1.049	0.955					
1.660	2.33 2.40	1.380 1.380	1.286 1.286	1.250	1.250	1.135	0.62	7/8-20 UNEF
1.900	2.40 2.60 2.90	1.650 1.610 1.610	1.516 1.516 1.516	1.500	1.500	1.448	0.75	1 1/8-16 UN
2.000	3.40	1.670	1.576	1.500	1.500	1.448	0.75	1 1/8-16 UN
2.063	3.25 3.40	1.751 1.750	1.657 1.657	1.625	1.625	1.536	0.75	1 1/8-16 UN
2.375	4.60 4.70	1.995 1.995	1.901 1.901	1.875	1.875	1.791	1.00	1 3/8-14 UN
2.875	6.40 6.50	2.441 2.441	2.347 2.347	2.313	2.313	2.205	1.38	1 3/4-12 UN
3.500	9.30 10.30	2.992 2.922	2.867 2.797	2.750	2.750	2.635	1.75	2 1/4-12 UN
4.000	10.90 11.00	3.476 3.476	3.351 3.351	3.313	3.313	3.135	2.12	2 3/4-12 SLB
4.500	12.75	3.958	3.833	3.813	3.813	3.725	2.62	3 1/16-12 SLB
5.000	13.00	4.494	4.369	4.313	4.313	3.990	2.62	3 1/4-12 SLB
5.500	17.00	4.892	4.767	4.562	4.562	4.455	3.12	4-12 SLB

Order X Equalizing Subs With X or XN Lock Mandrels.



## OTIS LANDING NIPPLES AND LOCK MANDRELS - Continued

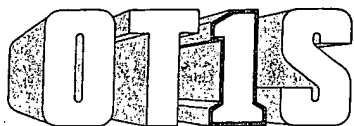
GUIDE TO OTIS R AND RN LANDING NIPPLES AND LOCK MANDRELS

Chart #0057z-c

TUBING				FOR HEAVY TUBING WEIGHTS			LOCK MANDREL	
				R	RN			
SIZE (IN)	WT. LB/FT	I.D. (IN)	DRIFT (IN)	NIPPLE BORE (IN)	PACKING BORE (IN)	NO-GO I.D. (IN)	I.D. (IN)	THREADS
1.315	2.25	0.957	0.848	AVAILABLE ON REQUEST				
1.660	3.02	1.278	1.184	1.125	1.125	1.012	AVAILABLE ON REQUEST	
1.900	3.64	1.500	1.406	1.375	1.375	1.250	0.62	7/8-20 UNEF
2.375	5.30	1.939	1.845	1.781	1.781	1.640	0.88	1 3/8-14 UN
	5.95	1.867	1.775	1.710	1.710	1.560	0.75	1 1/8-16 UN
	6.20	1.853	1.759					
	7.70	1.703	1.609	1.500	1.500	1.345	0.62	1 1/8-16 UN
2.875	7.90	2.323	2.229	2.188	2.188	2.010	1.12	1 3/4-12 UN
	8.70	2.259	2.165	2.125	2.125	1.937	0.88	1 3/8-14 UN
	8.90	2.243	2.149					
	9.50	2.195	2.101	2.000	2.000	1.881	0.88	1 3/8-14 UN
	10.40	2.151	2.057					
3.500	11.00	2.065	1.971	1.875	1.875	1.716	0.88	1 3/8-14 UN
	11.65	1.995	1.901					
	12.95	2.750	2.625	2.562	2.562	2.329	1.38	2-12 SLB
4.000	15.80	2.548	2.423	2.313	2.313	2.131	1.12	1 3/4-12 UN
	16.70	2.480	2.355					
4.500	17.05	2.440	2.315	2.188	2.188	2.010	1.12	1 3/4-12 UN
	11.60	3.428	3.303	3.250	3.250	3.088	1.94	2 5/8-12 SLB
	13.40	3.340	3.215	3.125	3.125	2.907	1.94	2 5/8-12 SLB
5.000	12.75	3.958	3.833	3.813	3.813	3.725	2.12	3 1/16-12 SLB
	13.50	3.920	3.795	3.688	3.688	3.456	2.38	3 1/16-12 SLB
	15.50	3.826	3.701					
5.500	16.90	3.754	3.629	3.437	3.437	3.260	1.94	2 3/4-12 SLB
	19.20	3.640	3.515					
6.000	15.00	4.408	4.283	4.125	4.125	3.913	2.75	3 1/4-12 SLB
	18.00	4.276	4.151	4.000	4.000	3.748	2.38	3 1/16-12 SLB
6.625	17.00	4.892	4.767	4.562	4.562	4.455	2.85	3 3/4-12 SLB
	20.00	4.778	4.653					
7.000	23.00	4.670	4.545	4.313	4.313	3.987	2.62	3 1/4-12 SLB
	15.00	5.524	5.399	5.250	5.250	5.020	3.50	4 1/2-8 SLB
7.625	18.00	5.424	5.299					
	24.00	5.921	5.796	5.625	5.625	5.500	3.50	4 1/2-8 SLB
8.000	28.00	5.701	5.666					
8.625	17-32	.....	.....	5.962	5.962	5.750	3.75	5 1/16-8 SLB

Order R Equalizing Subs With R or RN Lock Mandrels.





# Subsurface Flow Control Completion Equipment

## OTIS LANDING NIPPLES AND LOCK MANDRELS - Continued

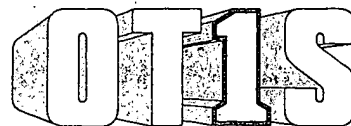
### GUIDE TO OTIS S AND N LANDING NIPPLES AND LOCK MANDRELS

Chart #0040z-c

TUBING				FOR STANDARD TUBING WEIGHTS			LOCK MANDREL	
				S	N			
				SIZE (IN)	WT. LB/FT	I.D. (IN)	DRIFT (IN)	NIPPLE BORE (IN)
1.050	1.20	0.824	0.730	0.714	0.714	0.656	0.18	1/2-20 UNF
1.315	1.80	1.049	0.955	0.875	0.875	0.850	0.34	1/2-20 UNF
1.660	2.33	1.380	1.286	1.250	1.250	1.135	0.47	1 1/16-16 UNF
	2.40	1.380	1.286					
	3.02	1.278	1.184	REFER TO T AND Q LANDING NIPPLE AND LOCK MANDREL CHART.				
1.900	2.40	1.650	1.516	1.500	1.500	1.448	0.56	7/8-14 UNF
	2.60	1.610	1.516					
	2.90	1.610	1.516					
	3.64	1.500	1.406	REFER TO T AND Q LANDING NIPPLE AND LOCK MANDREL CHART.				
2.063	3.25	1.751	1.657	1.625	1.625	1.536	0.56	7/8-14 UNS
	3.40	1.750	1.657					
2.375	4.60	1.995	1.901	1.875	1.875	1.791	0.69	1 1/8-12 UNF
	4.70	1.995	1.901					
	5.30	1.939	1.845	REFER TO T AND Q LANDING NIPPLE AND LOCK MANDREL CHART.				
2.875	6.40	2.441	2.347	2.313	2.313	2.205	0.88	1 11/32-14 UNS
	6.50	2.441	2.347					
	7.90	2.323	2.229	REFER TO T AND Q LANDING NIPPLE AND LOCK MANDREL CHART.				
3.500	9.30	2.992	2.867	2.875	2.875	2.760	1.50	1 7/8-12 UN
	10.30	2.922	2.797					
	REFER TO T AND Q LANDING NIPPLE AND LOCK MANDREL CHART.							
4.000	10.90	3.476	3.351	3.313	3.313	3.135	1.56	2 1/8-12 UN
	11.00	3.476	3.351					
	12.75	3.958	3.833	3.813	3.813	3.725	2.25	2 3/4-12 UN
4.500	13.50	3.920	3.795					
	15.50	3.826	3.701					
	REFER TO T AND Q LANDING NIPPLE AND LOCK MANDREL CHART.							

For S Mandrels order S Locator.

For N Mandrels order N No-Go Subs.



## OTIS LANDING NIPPLES AND LOCK MANDRELS - Continued

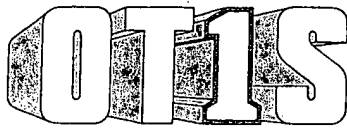
### GUIDE TO OTIS T AND Q LANDING NIPPLES AND LOCK MANDRELS

Chart #0060z-c

TUBING				FOR HEAVY TUBING WEIGHTS			LOCK MANDREL	
				T	Q			
				NIPPLE BORE (IN)	PACKING BORE (IN)	NO-GO I.D. (IN)		
SIZE (IN)	WT. LB/FT	I.D. (IN)	DRIFT (IN)				I.D. (IN)	THREADS
1.315	1.80	1.049	0.955	0.875	0.875	0.850	0.34	1/2-20 NF
1.660	2.33	1.380	1.286	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	2.40	1.380	1.286					
	3.02	1.278	1.184	1.125	1.125	1.050	0.34	9/16-18 NF
1.900	2.40	1.650	1.516	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	2.60	1.610	1.516					
	2.90	1.610	1.516					
	3.64	1.500	1.406	1.438	1.438	1.401	0.56	7/8-14 UN
2.063	3.25	1.751	1.657	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	3.40	1.750	1.657					
2.375	4.60	1.995	1.901	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	4.70	1.995	1.901					
		5.30	1.939	1.845	1.781	1.781	1.719	0.69
2.875	6.40	2.441	2.347	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	6.50	2.441	2.347					
		7.90	2.323	2.229	2.188	2.188	2.063	0.88
3.500	9.30	2.992	2.867					
	10.30	2.922	2.797	2.750	2.750	2.635	1.50	1 7/8-12 UNF
4.000	10.90	3.476	3.351	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	11.00	3.476	3.351					
4.500	12.75	3.958	3.833	REFER TO S AND N LANDING NIPPLE AND LOCK MANDREL CHART.				
	13.50	3.920	3.795					
		15.50	3.826	3.701	3.688	3.688	3.500	2.25

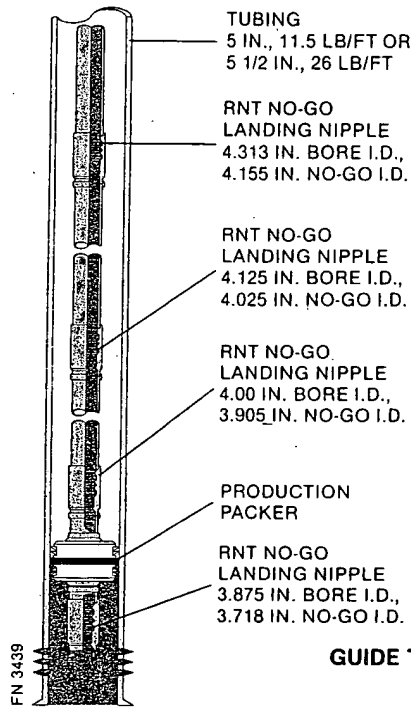
For T Mandrels order T Locator.

For Q Mandrels order Q No Go Subs.



# Subsurface Flow Control Completion Equipment

## OTIS LANDING NIPPLES AND LOCK MANDRELS - Continued



Otis® RNT No-Go Landing Nipples provide a means of running a series of no-go nipples in a single tubing string. This is accomplished by the nipples giving a taper (or step-down) to the tubing string I.D., from top to bottom. RNT Nipples may be used with tapered tubing strings as well as with constant I.D. tubing strings.

RNT No-Go Landing Nipples permit the landing of Otis flow controls on Otis RNT Lock Mandrels in predetermined nipple locations in the tubing. The RNT designation signifies an RN key profile with an enlarged no-go I.D. as compared to the standard RN series. This allows a maximum no-go I.D. on the lowermost nipple in a string of RNT Nipples. Otis RNT Locks and Equalizing Subs must be used in the Otis RNT Nipples since the key profile to no-go length on the nipples is different from that of Otis RN Nipples.

The RNT Lock Mandrels for any given series will have the same size I.D. and fish neck (except for the 6 5/8" - 29 lb. series) facilitating the usage of one running tool, pulling tool and equalizing prong for each series.

### GUIDE TO OTIS RNT NO-GO LANDING NIPPLES AND LOCK MANDRELS

Chart #0048z-c

TUBING				RNT		LOCK
SIZE (IN)	WT. LB/FT	I.D. (IN)	DRIFT (IN)	PACKING BORE (IN)	NO-GO I.D. (IN)	MANDREL I.D. (IN)
4 1/2	12.7	3.958	3.833	3.813	3.725	1.940
5	24.2	4.000	3.875	3.688	3.456	
				3.437	3.343	
				3.313	3.155	
4 1/2	13.5	3.920	3.795	3.688	3.456	1.940
				3.437	3.343	
				3.313	3.155	
				3.125	3.023	
5	11.5	4.560	4.435	4.313	4.155	2.380
5 1/2	26.0	4.548	4.423	4.125	4.025	
	26.8	4.548	4.423	4.000	3.905	
				3.875	3.718	
5	15.0	4.408	4.283	4.125	4.025	2.380
5 1/2	28.4	4.440	4.315	4.000	3.905	
				3.875	3.718	
				3.688	3.456	
5 1/2	17.0	4.892	4.767	4.688	4.587	2.750
				4.562	4.445	
				4.313	4.155	
				4.125	4.025	
5 1/2	20.0	4.778	4.653	4.562	4.445	2.380
				4.313	4.155	
				4.125	4.025	
				4.000	3.905	

TUBING				RNT		LOCK
SIZE (IN)	WT. LB/FT	I.D. (IN)	DRIFT (IN)	PACKING BORE (IN)	NO-GO I.D. (IN)	MANDREL I.D. (IN)
6	15.0	5.524	5.399	5.250	5.018	2.750
	18.0	5.424	5.299	4.813	4.710	
				4.688	4.587	
				4.562	4.445	
6 5/8	20.0	6.049	5.924	5.813	5.655	3.500
				5.625	5.520	
				5.500	5.280	
				5.250	5.018	
6 5/8	24.0	5.921	5.796	5.710	5.535	3.500
				5.500	5.280	
				5.250	5.018	
				4.813	4.710	2.750
7	26.0	6.276	6.151	5.963	5.843	3.500
	29.0	6.184	6.059	5.813	5.655	
				5.625	5.520	
				5.500	5.280	
7	32.0	6.094	5.969	5.750	5.645	3.500
				5.625	5.520	
				5.500	5.280	
				5.250	5.018	

Order No-Go Equalizing Sub with Lock Mandrel.